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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,830	01/31/2002	Qin Liu	10014405-1	2306

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HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, CO 80527-2400

EXAMINER	
YUAN, DAH WEI D	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 03/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/061,830	LIU ET AL.	
	Examiner	Art Unit	
	Dah-Wei D. Yuan	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 January 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,11-17,20 and 82-89* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,11-17,20 and 82-89* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

FUEL CELL WITH FUEL DROPLET FUEL SUPPLY

Examiner: Yuan S.N. 10/061,830 Art Unit: 1745 March 9, 2005

Detailed Action

1. The Applicant's amendment filed on January 11, 2005 was received. Claims 90-97 were cancelled. Claims 11,14,15,82,83 were amended.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action issued on October 4, 2004.

Specification

3. The amendment filed on January 11, 2005 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: fuel supply apparatus directs a plurality of droplets into the fuel passage in direction that is substantially parallel to the anode surface.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

4. The claim rejections under 35 U.S.C. 112, first paragraph, on claims 82,84-89 are withdrawn, because claim 82 has been amended and support for the amendment can be found in Figure 18.

5. Claim 83 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The limitations "fuel supply apparatus directs a plurality of droplets into the fuel passage in direction that is substantially parallel to the anode surface" in claim 83 are not supported in the specification. If applicant believes said limitations are fully defined, it is requested that applicant indicates column and line, and/or figure with number, in the instant disclosure.

Claim Rejections - 35 USC § 102

6. Claims 1-3,7,8,11-15,17,20,82,84,85,89 are rejected under 35 U.S.C. 102(e) as being anticipated by Kindler et al. (US 6,440,594 B1).

With respect to claims 1,3,8,11,14,85, Kindler et al. teach a direct oxidation fuel cell system comprising a plurality of anodes, a plurality of cathodes, a plurality of electrolyte and a fuel reservoir. The fuel is provided in the form of an aerosol of liquid fuel droplets suspended in a gas. The aerosol is formed in a single aerosol generator situated within the anode chamber of the fuel cell. Figure 6 is a schematic representation of a preferred fuel cell system incorporating a stack of individual membrane electrode assemblies. The fuel cell is formed by joining a plurality of anode biplates (602) and a plurality of cathode biplates (604), wherein the anode biplate (602) has an internal surface comprising a flowfield element (610) and an atomizer. The anode pair is interpreted as the series of the anode bipolar plates (602) as shown in Figure 6, wherein fuel is distributed between at least one anode pair along the fuel passage therebetween.

Kindler et al. further teach the fuel cell system comprising an aerosol generator (21) (a single fuel supply apparatus), which comprises a plurality of atomizers (25) that form an aerosol of liquid fuel droplets suspended in the anode. Alternatively, the pump (20) or the can be considered as the single fuel supply apparatus. See Abstract; Column 1, Line 64 to Column 2, Line 11; Column 3, Lines 29-34; Column 5, Lines 27-47; Column 15, Line 57 to Column 16, Line 21; Figure 6.

With respect to claim 2,13,17,20,84, the amount of aerosol fuel delivered to the anode depends upon the particular oxidation catalyst used in the anode, the permeability of the membrane in the electrode assembly to liquid fuel, the fuel concentration in the aerosol droplets, and the temperature and pressure within the cell. By monitoring fuel cell operating characteristics it is possible to determine an optimum aerosol feed rate for a give fuel cell configuration and cell operating conditions. For example, monitoring fuel cell power output, cell potential, or operating current provides convenient measures of fuel cell operating performance suitable for use in controlling the rate of aerosol fuel delivery to the anode. Preferably, the fuel droplet delivery rate is controlled by varying the duty cycle of the aerosol generator to maintain a desired cell output potential at a given power output. See Column 7, Lines 31-67. Kindler et al. do not specifically disclose the presence of a controller in the fuel cell system. However, it is the position of the examiner that such controller is inherent, given that both Kindler et al. and the present application utilize similar operation procedure and control sequence to operate the direct oxidation fuel cell system. Also, a controller would be essential to monitor and regulate the fuel droplet delivery rate into the fuel passage. A reference which is silent about a claimed

invention's features is inherently anticipatory if the missing feature *is necessarily present in that which is described in the reference.* In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 7,12,15,89, Kindler et al. further teach any number of means for forming an aerosol may be employed. For example, an aerosol may be formed by heat the fuel to a temperature above its boiling point in the presence of the suspending gas, then rapidly cooling the superheated fuel vapor to nucleate condensed droplets of liquid fuel suspended in the gas. The aerosol is preferably formed by atomizing the liquid fuel into the suspending gas. A wide variety of atomization means are known to those skilled in the art and may be employed in this invention. These include orifices, single fluid atomization nozzles (airless sprayers), two fluid atomization nozzles (gas-assisted sprayers), rotating discs or wheels onto which the liquid is fed, or ultrasonic nozzles in which liquid is feed onto a needle or orifice oscillated at very high frequency to form liquid droplets in a suspending gas. See Column 7, Lines 14-30.

With respect to claim 11, Kindler further teaches the use of a methanol reservoir to provide the fuel. See Figure 1.

With respect to claim 14, Kindler further teaches the fuel droplets rest on either surfaces of the anode biplate. See Figure 4, Column 13, Lines 46-65.

With respect to claim 82, Kindler et al. teach the aerosol generator directs a plurality of fuel droplets into the fuel passage in a direction that is non-perpendicular to the anode biplate as evidenced in the disclosures of Figures 4 and 6.

Claim Rejections - 35 USC § 103

7. Claims 4-6,86-88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kindler et al. Kindler et al. (US 6,440,594 B1) as applied to claims 1-3,7,8,11-15,17,20,82,84,85,89 above.

Kindler et al. disclose a fuel cell system comprising an ultrasonic atomizer as the fuel supply apparatus as described above in Paragraph 6. However, Kindler et al. do not specifically disclose the use a thermal drop ejector, a piezoelectric drop ejector, or a flextensional drop ejector to produce the fuel droplets into the fuel passage. Nevertheless, Kindler et al. disclose the amount of fuel delivered to the anode may be manipulated by adjusting the atomization conditions; for example, liquid feed rate, nozzle pressure, rotational speed of the disk, or oscillation frequency or power for an ultrasonic nozzle. Such methods are well known to those skilled in the art. Alternatively, the atomizer may be operated in a discontinuous manner, for example, by pulsing the liquid feed to the atomizer or pulsing the delivery of liquid-fuel droplets from the atomizer. For example, the atomizing gas (for a two fluid atomization nozzle), rotational means (for a rotary nozzle) or oscillation means (for an ultrasonic nozzle) may be turned on or off alternately in a pulsed manner in order to maintain the desired fuel droplet delivery rate as reflected by the measured cell output potential and power output. Moreover, each in situ atomizer 612 may be selected from a wide variety of atomization means, including orifices, single fluid atomization nozzles (airless sprayers), two fluid atomization nozzles (gas-assisted sprayers), rotating discs or wheels onto which the liquid is fed, or ultrasonic nozzles in which liquid is feed onto a needle or orifice oscillated at very high frequency (typically

≥ 20 kHz) to form liquid droplets in a suspending gas. See Column 7, Lines 14-61; Column 15, Line 66 to Column 16, Line 10. Kindler reference teaches the delivery of droplet fuel using various means is well known to those skilled in the art. Therefore, it would have been obvious to one of ordinary skill in the art to substitute a thermal drop ejector (or a piezoelectric drop ejector, or a flextensional drop ejector) for the ultrasonic atomizer as the fuel droplet generating means in the fuel cell system disclosed by Kindler, because they are considered functionally equivalent fuel delivering means.

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kindler et al. (US 6,440,594 B1) as applied to claims 1-3,7,8,11-15,17,20,82,84,85,89 above, and further in view of Singh et al.

Kindler et al. disclose a fuel cell system as described above in Paragraph 6. However, Kindler et al. do not disclose that the fuel cell system further comprising storage means for storing energy generated by the system. Singh et al. teach an electrical storage device is coupled in parallel to a fuel cell power generation system. The electrical storage device is either a battery pack, a plurality of capacitors, or a plurality of supercapacitors. The electrical storage device is capable of minimizing the unreacted fuel within the anode chamber. See Abstract, Column 1, Lines 40-64; Column 2, Lines 3-29. Therefore, it would have been obvious to one of ordinary skill in the art to coupled an electrical storage device to the fuel cell system of Kindler et al. in parallel, because Singh et al. teach the use of either a battery pack, capacitors or supercapacitors to reduce the amount of excess fuel during transient operating conditions.

9. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kindler et al. (US 6,440,594 B1) as applied to claims 1-3,7,8,11-15,17,20,82,84,85,89 above, and further in view of Pun (US 6,152,382).

Kindler et al. disclose a method of operating a fuel cell as described above in Paragraph 6. However, Kindler et al. do not disclose the use of a fan in blowing the droplets towards the anode. Pun teaches that fans and blowers are required to project the atomized droplets to intended targets. See Column 1, Lines 22-25. Therefore, it would have been obvious to one of ordinary skill in the art to incorporate a fan on the method of operating a fuel cell of Kindler et al., because Pun teaches the use of a fan to help project the atomized droplets to the intended targets (anode plates) in the fuel cell system.

Response to Arguments

10. Applicant's arguments filed on January 11, 2005 have been fully considered but they are not persuasive.

Applicant's principle arguments are

(a) The Kindler patent does not teach a single fuel supply apparatus that supplies a plurality of fuel droplets to each of anodes;

(b) nowhere in Applicant's specification is it admitted that thermal, piezoelectric and flextensional drop ejector are functional equivalent of an ultrasonic atomizer;

(c) Pun reference is directed to a spray apparatus that produces uniform sized atomized droplets controllable from fog size to larger for spraying fungicides etc;

(d) claim 20 recites means to supply droplets at a rate that results in a fuel layer being maintained.

In response to Applicant's arguments, please consider the following comments.

(a) Kindler reference teaches a fuel cell system comprising an aerosol generator (21) (a single fuel supply apparatus. The aerosol generator further comprises a plurality of atomizers (25), which form an aerosol of liquid fuel droplets. See Column 5, Lines 39-42;

(b) Kindler et al. disclose the amount of fuel delivered to the anode may be manipulated by adjusting the atomization conditions; for example, liquid feed rate, nozzle pressure, rotational speed of the disk, or oscillation frequency or power for an ultrasonic nozzle. Such methods are well known to those skilled in the art. Kindler further teach an aerosol may be formed by heat the fuel to a temperature above its boiling point in the presence of the suspending gas, then rapidly cooling the superheated fuel vapor to nucleate condensed droplets of liquid fuel suspended in the gas. The aerosol is preferably formed by atomizing the liquid fuel into the suspending gas. A wide variety of atomization means are known to those skilled in the art and may be employed in this invention. These include orifices, single fluid atomization nozzles (airless sprayers), two fluid atomization nozzles (gas-assisted sprayers), rotating discs or wheels onto which the liquid is fed, or ultrasonic nozzles in which liquid is feed onto a needle or orifice oscillated at very high frequency to form liquid droplets in a suspending gas. The instant disclosure fails to distinctly discuss the structure, functionality and characteristic of various ejectors. It is difficult to render patentable weight on these fuel droplet ejectors without proper

description and understanding of their respective significance. Especially, Kindler teaches a wide variety of atomization means known to those skilled in the art can be employed in his invention;

(c) Pun reference relates to an apparatus and method for controlled droplet atomization and controlled projection of atomization droplets. See Abstract. The Kindler is an analogous art to the Pun reference, and both are pertinent to the subject matter of the instant disclosure. A prior art reference is analogous if the reference is in the field of applicant's endeavor or, if not, the reference is reasonably pertinent to the partials problem with which the inventor was concerned. In re Oetiker, 977 F.2F 1443, 1446, 24 USPQ2d 1443, 1445 (Fed Cir. 1992),

(d) Kindler reference only teaches it is preferable to prevent the anode, anode catalyst pores and any anode support or backing material, from becoming saturated (flooded) with liquid fuel. It does not explicitly exclude the possibility of forming a (discrete) fuel layer on the anode due to coalescence of the fuel droplets.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dah-Wei D. Yuan whose telephone number is (571) 272-1295. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Dah-Wei D. Yuan
March 10, 2005